

NATIONAL AIR INTELLIGENCE CENTER



PROSPECTS FOR WEAPONS, TROOPS, AND BATTLEFIELDS
IN THE INFORMATION AGE

by

Chang Mengxiong

DISC QUALITY COPY



Approved for public release:
distribution unlimited

19960408 150

HUMAN TRANSLATION

NAIC-ID(RS)T-0636-95

6 February 1996

MICROFICHE NR: 96C000052

PROSPECTS FOR WEAPONS, TROOPS, AND BATTLEFIELDS
IN THE INFORMATION AGE

By: Chang Mengxiong

English pager: 33

Source: Unknown

Country of origin: China

Translated by: Leo Kanner Associates

F33657-88-D-2188

Requester: NAIC/TASC/Mr. Richard A. Peden, Jr.

Approved for public release: distribution unlimited.

THIS TRANSLATION IS A RENDITION OF THE ORIGINAL
FOREIGN TEXT WITHOUT ANY ANALYTICAL OR EDITO-
RIAL COMMENT STATEMENTS OR THEORIES ADVOC-
ATED OR IMPLIED ARE THOSE OF THE SOURCE AND
DO NOT NECESSARILY REFLECT THE POSITION OR
OPINION OF THE NATIONAL AIR INTELLIGENCE CENTER.

PREPARED BY:

TRANSLATION SERVICES
NATIONAL AIR INTELLIGENCE CENTER
WPAFB, OHIO

GRAPHICS DISCLAIMER

All figures, graphics, tables, equations, etc. merged into this translation were extracted from the best quality copy available.

PROSPECTS FOR WEAPONS, TROOPS, AND BATTLEFIELDS
IN THE INFORMATION AGE

Chang Mengxiong

Beijing Institute of Systems Engineering
Beijing 100101

ABSTRACT: This is a high-level soft scientific research report in predicting future developments in military trends. In the fundamental viewpoint, weapons and troops are currently on the eve of great technical innovation. Weapons and troops in the 21st century are the "informationized" weapons and troops. Their concrete realization constitutes 12 aspects: informationized ammunition, informationized soldiers, informationized combat platform, defense information system (C³I), informationized weapon system, informationized battlefield, information warfare, information intimidation, combat command system with combination of high centralization and high automation, as well as smooth transition from virtual weapons and virtual battlefields toward real weapons and real battlefield. Intensity is the matrix indicator of troops in the 21st century; troops will be the highest cultural and technical component in the society, as the informationized weapons still require other technical supports. In the last part of the paper, a 28-character methodology is presented by the author in studying weapons and troops of the 21st century: based on major technical progress, new conceptual weapon systems are set forth, new types of combat are initiated,

and simulation is applied to verify feasibility.

KEY WORDS: weapons, troops, modern warfare, informationization, methodology.

I. Weapons and Troops Are on the Eve of Major Innovations

Since 1993, the U.S. military has had growing enthusiastic discussions on the military technical innovations and the military revolution. One of the representative personnel is four-star general Sullivan, U.S. Army Chief of Staff.

They have the following view: the Gulf War was a war fought with new weapons and equipment on the traditional style. This is the earliest-stage form of high-tech warfare in the information age. The representative combat weapons, aircraft, tanks, and aircraft carriers, among others, in the industrial age may lose their importance. As their replacement, highly destructive and long-range precision guided weapons come on the scene. Military theories will also be impacted as innovations of combat policy; concept and regulations are unavoidable. The combat forms may break through the boundaries among the various branches of the armed forces. In combat, large numbers of troops will not be concentrated, but instead the deployment of decentralized fighting-power units with concentrated assault firepower will be put into action, etc.

They clearly propose that warfare in the information age of the 21st century is quite different from warfare in the 20th century. The future battlefield will be a digitized battlefield. First, the information warfare should be won. Combat laboratories should be built to develop weapons and train troops by using large-scale simulation. The U.S. Army of the 21st century should be built up, etc.

As revealed by various facts, we are in the midst of new military innovations. Electronic information technology is the core technology to provide unprecedented conditions by using information in large quantities and universally among weapons and troops, thus providing new opportunities for the development of weapons and equipment. The curtain of this revolution has been lifted. Its high tide will occur between 2005 and 2010. A military revolution covering the entire military field will be initiated.

Information is a fundamental attribute of things; information exchange is a fundamental form of interaction among things; the so-called informationization in a certain area is utilization of information in large quantities and universally in such areas. China should carry out its Four Modernizations of industry, agriculture, science and technology, as well as national defense, early in the next century. Informationization is indispensable to any modernization of the four. Informationization is the common developmental trend of all of human society.

In the view of the author, weapons and troops of the 21st century will be informationized. Informationization is the main hallmark distinguishing troops of the 21st century from those of the 20th century. The military struggle in the 21st century aims at military and political purposes. On multiple levels, the military struggle is elaborated on the utilization, and against the utilization of information. All these are very important developmental trends. This is also an important problem on which research is required in military futuristics.

In this paper, some prospects in this major trend will be dealt with in many segments. The so-called prospect is events in the years 2010 to 2020, as viewed from the worldwide developmental trends.

II. Weapons and Troops in the 21st Century Are Informationized Weapons and Troops

2.1. Informationized ammunition

(1) The ammunition referred to here is that portion of a weapon that has the direct-hit effect and the destruction effect. Informationized ammunition includes the precision-guided weapons, which include guided bombs, guided cannon rounds, guided dispenser and bomblets, cruise missiles, terminal guidance missiles, and antiradiation missiles, among others. They are actually a kind of ammunition that can acquire and utilize the position information provided by the target to be attacked in order to revise its trajectory so that the target can be hit precisely. These weapons have a certain level of intelligence, capable of being fired outside the enemy's firepower effective range to autonomously recognize and attack the target. The circular error probability of the hit precision will approach zero. As verified in the Gulf War, precision-guided weapons are the fundamental firepower in high-tech warfare. This is a major category of continuously and vigorously developing weapons.

Informationized ammunition is another realization of precision-guided weaponry. This presentation can inspire people to explore ammunition to make adequate use of information. Intelligent land mines and intelligent submarine mines abroad can automatically roll and sail toward a target after detecting the target information, and destroy the target. Reactive tank armor is actually detecting information on the incoming strike ammunition and utilizing this information for its timely detonation.

Some new information will emerge. This ammunition will utilize all possibly utilizable direct or indirect target information, whether relying on acoustic waves, radio waves,

visible light, infrared, laser, and even gas and smell. In the 21st century all ammunition other than ammunition for rifle and machine gun will be informationized ammunition.

(2) The variations of forms of combat engendered by this development are as follows: over-the-horizon precision firepower attack may possibly become the fundamental type of firepower attack. Blind shooting and carpet type bombing will become a backward form of combat, with a low effect-to-cost ratio. Destruction outside of the combat target will also be greatly reduced.

2.2. Informationized Soldiers

(1) Soldiers of the 21st century are not only equipped with traditional rifles and hand grenades, but also carry with them small-size, lightweight, integrated electronic information equipment. This equipment has the personal radio communication function, GPS type guidance positioning function, personal computer, and other networking functions, night vision functions, function of discriminating between friend or foe, alarming function, and firing command function for some informationized ammunition, among others. These soldiers wear clothing that can automatically adjust for temperature and automatically change the color. In certain situations, a soldier may possibly use his personal flying device.

(2) Informationized soldiers can receive various kinds of information related to combat. He can receive highly concentrated commands; when necessary, he may even find it possible to directly receive an order from the division commander. He also can highly autonomously fight against the enemy according to the combat intentions of the upper echelons and his acquired information.

With the informationized soldiers of the 21st century as the foundation, infantry or special troop units are organized. Their combat capability is a quantum leap over the soldiers of the 20th century. With such informationized soldiers, the troop units thus organized are very much different from the troops of the 20th century in forms of combat and organizational systems.

2.3. Informationized Combat Platform

(1) In the 21st century, the manned combat platforms, such as aircraft, warships, and armored vehicles, will have installed large numbers of electronic items of equipment so that each informationized combat platform is a nodal point of a large C³I system of a certain level of the troop unit. The combat platform has multiple items of communication equipment in order to exchange combat information with his upper echelons and with friendly units. The platform has multiple items of probe equipment in order to detect enemy targets to provide target information for precision firepower attack. The platform has sufficient computer and networking capability, capable of providing timely and effective supplementary information for combat activities.

In addition to sufficiently utilize information from our side and the other side, the informationized combat platform has sufficient capability against the enemy's utilization of their information. This is electronic warfare equipment, with functions of reconnaissance, jamming, and deception.

(2) Invisibility is a manifestation form of informationization. In reality, invisibility technique is a technique such that the other side is unable to utilize radar, infrared and other means to acquire information about our side. At present, there are invisible aircraft and invisible surface ships; other invisible combat platforms will appear. For

example, fitting acoustic silencing tiles outside a submarine hull is also an invisibility measure. This approach can prevent the other side's sonar from acquiring the position information of the submarine.

(3) Remote control and miniaturization are also an unavoidable trend. Aircraft pilots and tank drivers may possibly become remote control operators outside of the firepower circle. Combining the precision guided weapons and the C³I system, very great threat can be applied to the large and superlarge combat platforms, which are unable to resist all these means, so that miniaturization is a route to be taken.

(4) Many robotic soldiers as discussed in China and abroad are actually unattended carriers with killing firepower; the carrier has a certain capability of acquiring and processing information. This is within the range of unattended informationized combat platforms, as its exterior shape can be quite different from humans. Robotic soldiers and informationized soldiers are two basically different concepts. With the development of electronic information technology, some informationized combat platforms will develop in the direction of unattended informationized combat platforms. Early next century, robotic sentries, robotic engineering troops, robotic infantrymen, and even unattended intelligent tanks may appear in some battlefield environments.

(5) The informationized combat platforms will induce great variations in the forms of combat. Since the long-range precision striking distance of such platforms considerably exceed the visual distance of operators, and the scale, range and precision of combat coordination greatly exceed the level that noninformationized combat platforms in the twentieth century can attain. It is expected that in the year 2010 close combat between fighter planes (as the traditional forms of combat for

several decades) will be rarely seen. Tens and hundreds of tanks striking in coordination will not be frequent. Simultaneously firing by thousands of suppression cannons will be rarely seen. We are still unable to predict whether the very majestic aircraft carrier fighting groups can maintain their status. When robotic soldiers can be used in combat and be deployed in large numbers, we find it very difficult to imagine what changes in forms of combat will ensure.

2.4. National Defense Information (C³I) System

(1) The C³I system is communication, command, control, and information system. This is the nerve center of the entire informationized weapons and troops. While summarizing the experiences and lessons from the Gulf War by the various countries, they confirm the gigantic function of the C³I system in future wars, and stressed that anti-destruction decentralized C³I system is along the direction of development. some countries raised their investments in the system.

(2) In the next two decades, computer technology, communication technology, probe technology, and microelectronic technology are still the technologies with the fastest development. We can predict that the C³I system can still have very alarming development.

The space communication, reconnaissance, monitoring, navigation guidance, and positioning system by using satellites are the most important components of the C³I system. In the year 2010, with upgrades of the entire C³I system as well the performance of various satellites and expanded applications, it is possible that high level commanders can understand in time the events that occur at any point on earth. Thus, some aircraft pilots, tank drivers, and even soldiers can timely know their precise location on earth, capable of maintaining communication

links with the upper echelon command organization at any spot on earth. Moreover, precision navigation guidance information on targets outside of 1000km can be provided in real time and continuously for precision guided weapons.

Aircraft can be used as carriers for high-mobility radar probe, command control, electronic warfare, and communication relaying equipment or systems. This approach has many advantages as an unavoidable trend.

(3) In the future, the C³I system will exist at all places. Information sharing among combat personnel will be greatly upgraded. The target mode of development is an integrated defense information system, which has two possibilities in its relationship with the integrated information superhighway in the various countries: first, the networking and interconnection with sharing of some resources; secondly, the information system is an integral part of the information superhighway with coordinated operation.

(4) Since the C³I system is very important for informationized weapons and troops, striking and guarding of satellites (as a component of the C³I system) are the first space warfare we will see. Striking and guarding the aerial prealarming aircraft and electronic warfare aircraft will also become an important form of air war. Striking and guarding of the combat command posts and communication junctions will also become important combat forms of land war and air-to-surface war.

Further development and applications of the C³I will also induce changes in the command systems and troop organization.

2.5. Informationized Weapon Systems and Informationized Battlefield

(1) The weapons system of the 21st century is the informationized weapons system, which is composed of the informationized combat platform, informationized ammunition, and the corresponding C³I system.

By using informationized ammunition as the fundamental firepower, and rational organizing and deployment of multiple informationized combat platforms in executing different missions become an informationized combat group. The integrated combat effectiveness of this combat group has a quantum leap in quality; this is a main form of combat systems of weapons and equipment in the 21st century.

(2) In combat, only if one of two sides is the informationized combat groups of well trained personnel, this becomes an informationized battlefield.

(3) On the informationized battlefield, many matters are transparent. Both sides have facilities of major military value, such as military bases, communication junctions, and command centers. These facilities will be included in the combat data base of the other side, becoming targets aimed at by the precision guided weapons of the other side. Various military maneuvers are also very difficult to hide from the information reconnaissance system of the other side. These events can be displayed on a real-time basis in the data base of the other side. If the information capabilities of both sides are quite different, many matters are transparent only in one direction. As mentioned in The Art of War by Sun Zi, by knowing yourself and knowing the enemy, you fight a hundred battles and win them all. The winners are only the stronger side in information capability. Commanders of troops with high information capability can comparatively more easily reach a decision in the war room, by winning the war outside hundreds of miles away.

(4) The strategy, battle, and tactics adaptable to the informationized battlefield of the 21st century are different from those in the 20th century. The boundaries among the three will be fuzzy, and the contents in each will be subject to change.

In the combat forms of informationized troops in the 21st century, a practical viewpoint can only be presented by insightful research. This paper can only make some predictions. In the author's view, the major variation trend can be compared in general outline. The informationized combat forms resemble pointing to an acupuncture point by highly skilled practitioners. With few actions, subjugate the other party in a flash. By comparison, the noninformationized form of combat resembles wrestling by amateurs even with bloodletting and head-bashing, win or lose is still difficult to say.

2.6. Information Warfare

(1) Information warfare is a struggle of acquisition and counter-acquisition, suppression and anti-suppression, and deception and counter-deception of the information in firepower strikes and combat command, in addition to destruction and counter-destruction on information and sources of information. Moreover, there is fighting for the people's will and the soldier's morale with the means of television, broadcasting, and leaflets on the utilization and counter-utilization of information.

The concept of information warfare has been accepted by military theorists in the United States, Russia, and other countries. In an official document of the United States (Defense Report for Fiscal Year 1995), the United States Defense University has set up a curriculum on information warfare. Abroad, there are such presentations of information warfare and

command and control warfare. These are generally of the same category; however, in the view of this author, information warfare is a better nomenclature.

i. With close combination between information warfare and firepower warfare, by using information warfare to locate strike targets in firepower warfare, and sufficient manifestation of the firepower destruction, these results are premised on sufficient exploitation of the information function. This is very clear in the precision guided weapons, as well as tracking, aiming, reconnaissance, and revision by various types of cannons.

ii. Information warfare includes the C³I countermeasures, ensuring safety and smooth connection of our communication, ensuring the effective operations of our detecting equipment without being jammed or destroyed, and ensuring many of our combat command computers operating normally without damage by computer viruses, and so on.

iii. Information warfare includes electronic warfare, not only including reconnaissance, jamming, and deception of the enemy C³I system, but also including the hard destruction of enemy radar by using antiradiation guided missiles.

iv. In the clash of information warfare at the strategic and tactical levels lies the vital clash of decoding and analysis as well as counterinterception and counterdecoding. Information warfare in this sense is waged at all times among the countries in the political and economic fields.

v. Information warfare, including psychological warfare, which is fighting for people's will and soldiers' morale through television, broadcasting, and leaflets, in order to create information beneficial to us and not to the enemy. In the Gulf War, United States troops parachuted large numbers of leaflets

urging surrender onto the Iraqi troops. Loudspeakers continuously broadcast information to shake the morale of the Iraqi troops. Important functions on mass surrender of Iraqi troops were the result. The Chinese proverb, songs of the country are all around, originated from a famous story about the siege of Gaixia by the founder of the Han dynasty to Xiangyu (by 206 B.C.). This was a successful conclusion of psychological warfare early in Chinese history.

(2) A new weapon based on a new concept will appear in the next century, the high-powered microwave weapon with intensive electromagnetic effect, the enemy's electronic equipment and electronic information systems are destroyed so that to render enemy weapon systems ineffective. This is a new weapon of waging information warfare. If a high-powered microwave bomb is ever made, this will be a special type of informationized ammunition.

(3) The information capability means the information support and information protection required by troops on combat command, coordinate action, precision strike, and logistic protection when executing a mission. The equipment basis supporting this capability is the C³I system, the electronic warfare system, and precision guided weapons. The information capability of troops is a type of combat capability such as the precision strike capability, air defense capability, and rapid ammunition casting capability, as absolutely indispensable in high-tech warfare, and even the most important combat capability.

Information superiority is a state of superiority possessed by the side with the higher information capability in combat. In a future high-tech warfare, not only can air superiority and sea superiority should be possessed, but the most important in the information superiority that should come first.

In the future, military terms may appear such as the power

of counter-information and the power of counter-electromagnetic measures.

(4) Information warfare is a form of combat with the largest number of varieties in 21st century war. This is also a kind of vital combat form to decide the winning or losing in war.

2.7. Information Intimidation

(1) Nuclear weapons appeared by the close of the Second World War. Successively, the concept of nuclear threat emerged in military theory. After the seventies, because of numerous high-tech conventional weapons coming on the scene, successively there appeared the concept of conventional intimidation in military theory. Nuclear and conventional intimidation is not only a theoretical problem, but also an intensive and practical restraining factor on the potential opponent in terms of practical military strength. The function of threat corresponds to Sun Zi's subjugating opposing troops without fighting.

(2) In the future, information intimidation may appear. Since weapons in war and its various sectors rely closely on electronic information technology, the information power with such superiority possesses an integral superiority over the weak information power. However, if the weaker information power can attack the information system of the stronger information power by acting on their weak point, similar it may be possible to greatly downgrade the effectiveness of the opponent's war machine. In other words, even if both sides have generally comparable hard weapons, if the weaker information power is unable to effectively weaken the opponent's information capability, the possibility of winning the war is very slim. Conversely, if one side can effectively weaken the information capability of the other side, even if its other capabilities are inferior, the opponent will not dare to provoke. Both situations

are in the field of information intimidation; this is a restraining factor on the outbreak of war. The information intimidating strategy is the skillful manifestation of our information intimidation capability, strategically.

2.8. Combat Command System, Highly Centralized and Highly Automated

(1) In modern warfare, centralized command, decentralized command, level-by-level command, level-bypassing command, and composite command are considered as necessary to exist. However, centralized command and the level-bypassing command are the most fundamental command modes.

In the Gulf War, it was proved that the highly concentrated combat command system as practiced in Iraq is unable to adapt to high-tech war. As pointed out in a special report by the American International Prediction Corporation, an indisputable lesson in the Gulf War was the highly concentrated command control system, from top level down, has been rendered obsolete. Troops relying on this system are unable to undertake and repair the combat damage to the C³I system, and they are also unable to catch up with the cyclic period: opponent's action--our decision--reaction is made. Facing the decentralized command control network, such troops are like hanging bags for opponent in boxing practice.

The former Joint Chiefs of Staff chairman in the United States, Army General J. W. Vessey, Jr., pointed out the following: "The principle of our command and control is decision-making by the lowest possible level. In this way, commanders in the field are provided with flexibility, in addition to resources, authority, and responsibility, so that utilization can be most effectively attained. By using C³ with the prescribed form, the really important information, but not excessive data,

is provided to the most appropriate personnel in a timely fashion from upper to lower level, and from left to right." In the past two years, considerable discussions were made in the military circles abroad on the decentralized command required for mobile warfare.

These have their reasons; however, it seems that only one aspect of the matter is discussed on the future command system.

(2) The informationized weapons system creates material conditions for the highly centralized combat command of the upper level so that a theater commander may plan his tactical action with an overall view. In the Gulf War, the air combat missions of 2000 sorties each day by the coalition forces were unifiedly prescribed by the Air Force information system. Executions were carried out by various countries and various branches of the Armed Forces. Later on, this capability and trend will be strengthened. The informationized weapon systems can also create material conditions for the highly automated combat command of the lower level. The decentralized C³I system has high counter-destruction properties, being capable of ensuring that lower-level commanders have the detailed, relevant combat information, thus decisively executing the on-the-scene situation based on the overall combat intentions of the upper level in order to attain the greatest combat effectiveness.

(3) In the 21st century, the combat command system must be a combination of high concentration and high autonomy. The number of levels will be reduced. The present command systems and regulations must be revised.

2.9. Smooth transition from virtual weapons and virtual battlefields to real weapons and real battlefields

(1) In 1992 edition of the Defense Strategy of Science and

Technology in the United States, seven military technical capabilities should be developed. One of them is the synthetic environments, which are composed of some simulation systems with interconnected networking. These simulations match highly with the practice, capable of representing various activities from the theater combat to the factory and manufacturing process. This environment is visualized as operators can completely dip into the simulated environment. Any defense system with computer can be finally included into this environment to provide simulation, models, and combat simulation to various combat platforms, C³I systems, and networks. By using these synthetic environments, an electronic battlefield can be formed, with the mixing of real targets and simulated targets, and from factory to battlefield. This environment can be applied at positions distributed widely apart so that the users, development personnel, and experimental personnel can effectively communicate with each other. This environment will provide preparatory activities for the war by generals and combat troops, and accompany them to move to the real battlefield.

The required key technologies are of electronic information technology. Among them, the virtual reality (VR) technique is a technique of using computer technology to make simulated, imaginary worlds. The computer generates activities of the simulated world with three-dimensional visual environment. The operator can visually wander in this virtual world, and change this visual virtual reality in real time with operator action, thus having a feeling of being really at the scene. This visual world may be weapons, battlefield, and factory. This environment is helpful to people in discussing problems requiring image thinking (including image memory and image association), thus with extensive prospects of military applications.

(2) The further development of synthetic environments as a concept of Americans will provide almost all military activities,

including demand, design, prototype fabrication, and manufacturing, as well as for training and combat readiness of troops, for prescribing regulations of composite combat, of prescribing emergency plans, and of post-combat assessment and historical analysis, thus providing an integrated environment. This is helpful to relatively smooth transition from virtual (conceptual) weapons and virtual (conceptual) battlefields to real weapons and real battlefields. The effect will be penetrating to various military activities. We are unable to understand clearly all the significance of the synthetic environments.

2.10. Metric Indicators of Troops in the 21st Century

The metric indicators of troops in the 21st century are like those recorded in some world-famous military yearbooks. Often some static numerical indicators are used for these indicators, including the number of personnel in the Army, Navy, and Air Force, types and numbers of various weapons and items of equipment, and so on. These static indicators are insufficient for the troops of the 21st century.

Since informationized troops sufficiently utilize various kinds of information, we should introduce a concept of intensity. The so-called intensity is the concept of number of events occurring in a definite time and space. We can discuss by examining the history of wars that real military superiority is actually superiority in local time and local space, or superiority of unit time and unit space. With this superiority, local victory can be obtained.

(1) Firepower intensity and destructive intensity

After discovering an enemy situation, the informationized troops can make a decision within a very short time to move and

concentrate powerful precision guided firepower to strike. Firepower intensity is the firepower computed in unit time and unit space; this intensity is very gigantic. The striking precision of a precision guided weapon is very high. The firepower intensity within local time and local space on a target to be attacked is very high, considerably higher than the firepower intensity that can be attained by noninformationized weapons. Although the total consumed ammunition is very enormous with blind firing, area firepower suppression, and carpet bombing in the noninformationized combat form, but the firepower intensity is actually very low with respect to a target to be attacked.

Compared with the firepower intensity, destructive intensity is a more direct and more fundamental concept. Its meaning is how much damage is done on the target to be attacked within unit time and unit space.

With the C³I system as the junction, the firepower intensity and destructive intensity waged by the informationized troops (composed of informationized ammunition, informationized soldiers, informationized combat platforms, and informationized weapon systems) are very gigantic. However, although the total amount of firepower that noninformationized troops can unleash is also very large, but the firepower and the destruction are very small as calculated with respect to intensity.

(2) Mobile intensity

With respect to combat soldiers and combat platforms, mobile intensity is the spatial distance that the troops can move per unit of time (in a day, in an hour, in a minute, or in a second). For troops, mobile intensity is the number of combat troops that can simultaneously make such movements. The continual development of dynamic technology continuously increases the

mobility of combat platforms. The continuous development of electronic information technology makes it possible to have precise coordination with large-scale mobility. In 2010, it will be possible to foresee global mobile combat of a composite group of the army, navy, and air force. It is possible that an army battalion of high mobile intensity is equivalent to two or more army battalions with low mobile intensity.

(3) Information intensity

The unique feature of informationized troops is sufficient utilization of information. Information intensity means the number of information units that an organized armed unit can utilize and counter-utilize per unit time and per unit space. The magnitude of information intensity is the vital feature of the magnitude of precision striking capability, the magnitude of coordinate combat capability, the magnitude of command control capability and the magnitude of electronic warfare capability. If the information intensity of troops is very low, it is very difficult to win a high-tech war. With regard to troops with quite different information intensities, the weaker-intensity troops are definitely weaker in combat capability.

(4) Supply intensity

Supply intensity is the number of various supply materials that can be provided to an organized troop unit per unit time, and for definite space. The total logistic amount of informationized warfare in the 21st century may be reduced somewhat than in 20th century war; however, the supply intensity will be increased in order to cope with the combat consumption in the high-destructive intensity and high mobile intensity.

2.11. Troops will be the highest quality members of culture and technology in society

A common realization formed from studying the Gulf War is respect for science, stressing of weapons, and the deciding factor being human quality. This is also a fundamental principle in military philosophy. In high-tech war, human factors are more outstanding. The exploitation of combat effectiveness of high-tech weapons, and the execution of correct strategy and tactics are determined by quality of the officers and the soldiers among the troops.

Everything will be affected by informationization in the future informationized society. Weapons will be informationized weapons; troops will be informationized troops; and combat will be informationized combat. The destructive capability of weapons will be greatly increased, but their numbers will be decreased. The combat capability of troops will be greatly upgraded, while their numbers will be decreased. Warfare is not only the contest of high technology and high intellectuality on an overall scale, not a contest of bodily strength, but also it is so in the local sector or even single soldier hand-to-hand encounter.

This determines that the culture and technical quality of military officers in the future information society should be higher than that of government employees of the state, and also be higher than the company managers active in the market-oriented economy. The cultural and technical qualities of soldiers should be higher than those of workers in high-tech industries. Therefore, troops will be the members of society who have the highest cultural and technical qualities. Otherwise, even with weapon informationization, such troops will be defeated.

2.12. Informationized weapons still require support from other technologies

Contributions by electronic information technology to weaponry are exhibited in the very marked upgrading of the hit

precision of the weaponry, in other words, hit the target precisely, thus upgrading the commander's capability of knowing ourselves and knowing the enemy, and greatly upgrading the capability of coordinated combat by troops. However, hitting it intensely requires upgrading the firepower of weapon warheads. To hit it from far away and hit it fast, one must rely on upgrading the capability of combat platforms and the firepower portion of the combat component.

Therefore, informationized weapons do not reject the applications of other high technologies and traditional technologies, but add new technical capabilities on the foundation of weapons growing out of these technologies. Informationized weapons require support from aeronautical technology, astronautical technology, warship technology, ordnance technologies, and military nuclear technologies. This relationship between the core technology and supporting technology, not heeding only electronic information technology, and disregarding others, and not proceeding without priorities.

III. Methodology for Prospects of Future Weapons and Troops

This section will discuss the methodology that the author attained on his viewpoint on informationized weapons and troops in the 21st century. In many problems, people have different views. One of the reasons is the absence of common methodology in studying the same problem, such as blind people touching an elephant, each blind person feeling only one part of the elephant.

3.1. Fundamental viewpoint

This author has discussed methodology in studying the development trend of society; he expressed and verified the following viewpoints:

i. Society's progress caused by technical progress transcends national boundaries; the development trends of society caused by trends in technical progress also transcends national boundaries.

ii. A method of studying the development trends of a future society is to begin on the variation of science and technology caused by various aspects of livelihood in the society, and to begin by studying the development trends of science and technology. In other words, this involves beginning from society's situation as actually existing and caused by technical progress in investigation and study. Analysis and synthesis are carried out on the foundation of these facts. Then, decisions and prospects concerning the future society are derived. Obviously, this method is not the only method of studying the future society; however, this is an indispensable method.

Based on the above-mentioned viewpoint, the author expressed the following views.

i. The same methodology should be followed in studying the development and weapons and troops, and in studying developments in the future society. The world should be considered as an entity and the analysis should begin from nation and troops in the advanced development stage, in particular, the analysis of the development level and development trends of defense science and technology, as well as weapons and equipment, thus attaining a scientific decision and prospects.

ii. The development trends in weapons and troops also transcend national boundaries. Sooner or later, various countries will work in the direction pointed out by these trends; however, the development rate and steps of various countries are different. This will be determined by the political, economic,

and technical conditions of the various countries, not amenable to be simply discussed on the same conditions.

iii. There are two tasks of military thinkers facing the future: first, they clearly understand the development trends on a worldwide basis. This is the common nature of studying things. Secondly, beginning from the actual situation of their own country, some ways of coping with the future are presented. This is the individual character of studying things. We should have both.

We can raise historical examples on the theory and research methods of military thinkers, Engels, Douhet, Mahan, and Fuller, as evidence. They stood on the height of the era to study future developments in weapons and troops, beginning from the global situations in science, technology, weapons, and troops, not confined to the situation in one particular country; they predicted the future more precisely to make new contributions to military science by their new viewpoints and new theories. However, their theories were not certainly used by their own countries. For example, Fuller's concept of blitzkrieg was not taken up by his country, Britain, but was followed by Hitler's Germany in the Second World War. This is an effective military theory.

3.2. 28-character methodology in studying weapons and troops in the 21st century.

In the author's view, the methodology of studying weapons and troops of the 21st century can be generalized in a total of 28 characters in four segments; based on major technical progress; new conceptual weapon systems are set forth; new types of combat are initiated; and simulation is applied to verify feasibility. This paper will describe and verify the meaning of these four segments.

3.2.1. Based on major technical progress

(1) To study the future weapons and troops, the foundation or the starting-point in studying the problem should be that major progress will be in the next two decades or so, in all technical realms, in particular, electronic information technology.

We can discover that, when examining the long history of war, the real foundation of promoting development and changes in weapons and troops is the weapons progress due to technical progress. In this respect, very penetrating discussions were made by Engels and some western military thinkers; we do not repeat it here.

As mentioned above, at present we are amidst a new revolution in military technology, with electronic information technology as the core technology, to provide never-before-heard-of opportunities in new developments in weapons and equipment. We are on the eve of major innovations in weapons and troops. This is a military revolution in the entire military realm. This viewpoint has become a common view of well-learned people in military circles of various countries. We should stand on the point that major progress will occur in science and technology in the next two decades, thus leading to major progress in weapons and equipment. This is the foundation or beginning-point in studying future weapons and troops; otherwise, our understanding will lag considerably behind reality.

(2) Developments in weapons and equipment have their rules; this is the combination of demand-pulled and technology-driven. The so-called demand-pulled indicates that in a certain historical time and combat environment, in order to defeat an enemy with certain weapons, we should develop more powerful weapons and equipment than the enemy's weapons and equipment.

The so-called technology-driven indicates that in a certain historical time, there is always some technologies that have faster progress, leading to the possibility of developing new weapons that are more powerful than the enemy's weapons. The combination of the two leads to new weapons.

This rule can be explained by the example of invisibility aircraft developed in the United States. Due to the development of detection technology, especially radar technology, from the fifties to the seventies, two major military powers, the United States and the Soviet Union, spent vast sums in completing large-scale air defense detection systems. These systems are effective in coping with the attacking aircraft with radar reflecting at several square meters. The new weapon sought after in penetrating this air defense system was demand-pulled at that time. The concept of invisibility aircraft was born in this demand. However, new wave absorption materials and the development of design technology on the exterior shape of aircraft provide a technical basis for the practical development of invisibility aircraft. This is technology-driven. The combination of the two leads to new model invisibility aircraft with radar reflecting area at 1/10 to 1/1000 of the conventional aircraft.

We can raise another example, the nuclear bomb. In the early forties, Einstein and other physicists realized the scientific and technical feasibility of building this ever-powerful weapon. To defeat Hitler's Germany, they jointly wrote to the U.S. president, Roosevelt, to propose to organize the development of the nuclear bomb. This is technology-driven. To defeat Germany and Japan, Roosevelt ordered that the development of the atomic bomb be organized, with success. Gigantic functions were exerted in the war against Japan; this is demand-pulled.

War is a primitive and cruel form of struggle existing for thousands of years in human history. To seek superiority in the struggle, seeking new weapons is almost a permanent demand. However, for new weapons that can be obtained in each specific historical time is actually determined by the technical foundation and technical progress at the time. This situation can be correctly proven in the historical focus of weapon development.

From the development of society and the corresponding technology to investigate weapon development, we can see that both are generally synchronized and are mutually adaptive. For thousands of years, weapons have been developed from cold weapons to hot weapons and then to high-tech weapons. Cold weapons correspond to agricultural society and its metal refining technology. This type of weapon converts human body energy into destructive force. Hot weapons are adaptable to industrial society and its machinebuilding technology and chemical technology. In this type of weapon, mainly the chemical energy is converted to destructive force and mobility force. Nuclear weapons are also hot weapons, converting nuclear energy into destructive force. High-tech weapons have unique features of utilizing and counter-utilizing information, adaptable to information society and its electronic information technology. High-tech weapons should be called informationized weapons.

Actually, the real basis of society's development is the progress brought forth by the technical progress on the means of production and livelihood.

(3) As manifested in a world-class well-known military work, The Art of War, by Sun Zi, the highly intelligence and stratagem concept have penetrating significance for guidance in war. However, this stratagem concept is unable to become the foundation and beginning-point in studying future weapons and

troops, because Sun Zi's fundamental stratagem thinking is the way of victory under the same conditions of weapons and equipment. In the 13 chapters of The Art of War, the contents really relate to weapons is the chapter, Attack with Fire. In modern language, this is only the combat application problem of some weapon equipment at present, not the problem of developing new weapons.

With respect to western military figures concerning science and technology, when confronted with difficult war problems, more thinking is focused on the utilization of new technology to improve weapon equipment. Frequently the technical factor is the beginning-point of the stratagem thinking. However, due to slow development of military technology in ancient China, militarists in China paid more attention to stratagems. Stratagems with high intelligence is an outstanding merit in China's art of war. A weak point in China's art of war is not paying attention to improvements of combat means. This difference still has vivid manifestations in today's theoretical thought between military circles of the East and the West.

When developing new weapon equipment, Sun Zi's stratagem concept can also be applied in certain aspects, such as in surprise, which means strict secrecy while developing new weapons. To restrain the opponent and not be restrained by the opponent indicates the dealing with opponent's weak point so that the other side is difficult to cope with. Development of invisibility aircraft in the United States can be said to be following these two lines of stratagem thinking. First, the project had been kept secret for more than 10 years. The existence of this type of aircraft was admitted after deployment of the F-117 Stealth aircraft in armed units. Secondly, this project dealt with the air defense system of the former Soviet Union. As expected by the United States, the then-existing air defense system of the Soviet Union was unable to cope with this

anticipated invisibility aircraft. If modifying the air defense system of the Soviet Union, the investments would be in the hundreds of billions of U.S. dollars. This would drag down the Soviet economy. In this case, the Soviet Union was in a dilemma.

(4) Military philosophy and, in particular, the military philosophy of Marx-Leninism, has major guidance functions as to war with a directional guidance function in studying the future weapons and troops. Engels had penetrating discussions on this point. However, military philosophy is unable to become the foundation or beginning-point in studying this problem. First, military philosophy is unable to anticipate the direction of technical progress, unable to anticipate new weapons due to technical progress, and unable to anticipate new combat forms caused by new weapons. Secondly, the philosophy should always develop with development of things; principle is not always the beginning-point in studying a problem.

3.2.2 New conceptual weapon systems

We can see, from studying the development history of weapon equipment from the beginning of this century to the present time, whether submarines, tanks, missiles, supersonic aircraft, atomic bombs, invisibility aircraft and C³I system, they are based on the military demand at that time, and invented and developed on the technical foundation that can be provided at the time. From this point, research into future weapons is not confronted with new methodological problems, but only requirements based on new military demand. When sufficiently studying the various technologies at present, and in particular, on the foundation of various opportunities and possibilities brought forth by the technical development of electronic information in order to have concepts of new weapons and new weapons systems, such new weapons or new weapons systems are the inheritance, collecting of success, development and new creation on the foundation of

present weapons to have dramatic upgrading. If dramatic upgrading is unable to be conceived, then it is possible that the thinking is not deep enough or the imaginative power is not sufficient. By using this conceptual weapon or weapon system, one should have major upgrading in the destructive intensity, mobile intensity, information intensity, and supply intensity in the future war. These four kinds of intensity are the metric indicators of future weapons and troops given by the author in previous passages.

Here the so-called concept is a thinking activity of prediction and anticipation; this does not include realization. The latter is not within the discussion area of this paper. As indicated in the development history of weapon equipment in recent decades, from concept to realization of a new weapon, a time period of more than decades is required, with vast investments. Of course, only by carrying out the concept can the concept become reality. Only time and practice can make the decision.

3.2.3 Creation of new combat forms

(1) New combat forms are created on the foundation of this new weapon system. In the early eighties, integration of air and ground war was presented by the U.S. Armed Forces. This is the activity of creating new combat forms. This creation should seriously summarize experiences and lessons from the history of war, and also should exploit new capabilities of military technology that new weapons and systems can provide. Therefore, this is a more difficult thinking activity than the conception of new weapon systems. By applying the combat forms, weapons, and troops of this creative thinking, can we have major upgrading of destructive intensity, mobile intensity, information intensity, and supply intensity in future wars.

The so-called creation is a creative thinking activity in concept. This does not include realization. The latter requires a series of decision-making and experimental activities by departments of military functions.

(2) Creation of new weapons and new combat forms are a complement to each other. New weapons are the material foundation of new combat forms; however, new combat forms are necessary conditions in exploiting the combat effectiveness of new weapons. It is unable to sufficiently exploit the capability and potential of new weapons by using the old combat forms. In the view of some military experts in the United States, the Gulf War was such kind of war.

(3) The contents of military theory are very abundant; however, the core contents of the future military theory are relatively concentrated. This consists of new weapons and new combat forms. After clarifying both problems, the other points are relatively easier to clarify, such as organizational systems, logistics protection, education and training, as well as strategy and tactics. If one studies the future military theory but not taking heed to these two problems, one lacks an important basis. This can be compared to catching fishes by climbing a tree.

Early in this century, Douhet's theory of victory through airpower, and Mahan's victory through seapower appeared. In mid-century, although Khrushchev was not a military theorist, yet he promoted the theory of victory through nuclear weapons when he was in power. In the final years of this century and the beginning years of the next century, new military theories such as winning through information, winning through electronics (and electromagnetics) means, winning through a new air force, and winning through space appeared. These possibly emerging new military theories are beneficial to vigorous military thinking, and should be encouraged, and not suppressed. As for to what

extent these theories meet with reality, the final judgment can only be made after time and practice.

3.2.4 Simulation applied to verify feasibility

(1) Advanced electronic information technology, and especially simulation technology and virtual reality technology based on computer technology provide new means and tools in studying future new weapons and new combat forms. This point was not confronted by our forerunners from Sun Zi to modern military thinkers, Engels, Douhet, Mahan, and Fuller, at the time. New theories advanced by them relied mainly on qualitative thinking of talent before verification with practice. Therefore, a time span of a decade or even several decades is required, from presentation to verification of these new military theories. By now we are possible to apply this method to verify feasibility. We should sufficiently emphasize this point.

(2) We should realize that with respect to the conceptual weapons and the conceptual combat forms, although simulation is not the final authority of verification, the final verification should be done by actual combat. However, this can be basically believable when verifying the false. In other words, the conceptual weapons and conceptual combat forms rejected by simulation research are unfeasible, generally speaking. This provides great convenience in studying the future weapons and future combat forms in greatly speeding up the process of obtaining a consensus, and greatly shortening the transition process from the conceptual (virtual) weapons and troops to real weapons and troops.

Generally speaking, the first three of the four segments can be considered as manifestations in research done by Dohet, Mahan, and Fuller, et al. They did not have conditions to carry out the fourth segments. This is the development by latecomers rather

than by the forerunners. In the present era, any one of these four segments is indispensable with mankind as the main object of understanding. However, with certain individuals as the main object of understanding, he may carry out one or several of the four segments, if his works can be verified through practice, this is a major contribution. However, simulation can be performed only by relying on high quality of research teams with advanced facilities and sufficient funds.

This paper was received for publication, on December 15, 1994.

DISTRIBUTION LIST

DISTRIBUTION DIRECT TO RECIPIENT

ORGANIZATION	MICROFICHE
B085 DIA/RTS-2FI	1
C509 BALL0C509 BALLISTIC RES LAB	1
C510 R&T LABS/AVEADCOM	1
C513 ARRADCOM	1
C535 AVRADCOM/TSARCOM	1
C539 TRASANA	1
Q592 FSTC	4
Q619 MSIC REDSTONE	1
Q008 NTIC	1
Q043 AFMIC-IS	1
E404 AEDC/DOF	1
E410 AFDTC/IN	1
E429 SD/IND	1
P005 DOE/ISA/DDI	1
1051 AFIT/LDE	1
PO90 NSA/CDB	1

Microfiche Nbr: FTD96C000052
NAIC-ID(RS)T-0636-95